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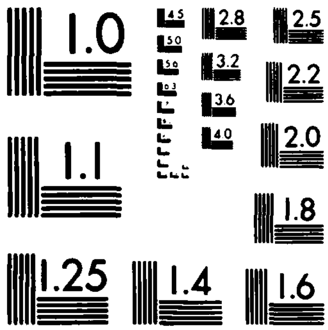

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FOREIGN TECHNOLOGY DIVISION

INDUCTION LINEAR ACCELERATOR

by

V.S. Bosamykin, A.I. Gerasimov, et al

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U. S. BOARD ON GEOGRAPHIC NAMES TRANSLITERATION SYSTEM

Block	Italic	Transliteration	Block	Italic	Transliteration
А а	*А а*	A, a	Р р	*Р р*	R, r
Б б	*Б б*	B, b	С с	*С с*	S, s
В в	*В в*	V, v	Т т	*Т т*	T, t
Г г	*Г г*	G, g	У у	*У у*	U, u
Д д	*Д д*	D, d	Ф ф	*Ф ф*	F, f
Е е	*Е е*	Ye, ye; E, e*	Х х	*Х х*	Kh, kh
Ж ж	*Ж ж*	Zh, zh	Ц ц	*Ц ц*	Ts, ts
З з	*З з*	Z, z	Ч ч	*Ч ч*	Ch, ch
И и	*И и*	I, i	Ш ш	*Ш ш*	Sh, sh
Й й	*Й й*	Y, y	Щ щ	*Щ щ*	Shch, shch
К к	*К к*	K, k	Ъ ъ	*Ъ ъ*	"
Л л	*Л л*	L, l	Ы ы	*Ы ы*	Y, y
М м	*М м*	M, m	Ь ь	*Ь ь*	'
Н н	*Н н*	N, n	Э э	*Э э*	E, e
О о	*О о*	O, o	Ю ю	*Ю ю*	Yu, yu
П п	*П п*	P, p	Я я	*Я я*	Ya, ya

*ye initially, after vowels, and after ъ, ь; e elsewhere.
When written as ё in Russian, transliterate as yё or ё.

RUSSIAN AND ENGLISH TRIGONOMETRIC FUNCTIONS

Russian	English	Russian	English	Russian	English
sin	sin	sh	sinh	arc sh	$\sinh^{-1}$
cos	cos	ch	cosh	arc ch	$\cosh^{-1}$
tg	tan	th	tanh	arc th	$\tanh^{-1}$
ctg	cot	cth	coth	arc cth	$\coth^{-1}$
sec	sec	sch	sech	arc sch	sech^{-1}
cosec	csc	csch	csch	arc csch	csch^{-1}

Russian	English
rot	curl
lg	log

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INDUCTION LINEAR ACCELERATOR

V.S. Bosamykin, A.I. Gerasimov, A.P. Klement'yev, A.I. Pavlovskiy

The well-known accelerating systems of linear induction accelerators are a series of series-connected transformers in which the independent primary circuits, which consist of energy storage devices, commutators, and connecting circuits located outside the accelerator, excite the magnetic fluxes in the torus-shaped ferromagnetic cores.

For the purpose of increasing the transformable power of the the operating frequency and lowering the cost of the accelerator, proposed is an induction linear accelerator in which all the elements of the primary circuit are united into an ironfree torus-shaped magnetic circuit being surrounded by a secondary circuit, which creates and holds the variable magnetic flux, which induces the vortex electrical field.

Figure 1 depicts one of the variants of the design of an iron--free accelerating system (the other variants can be distinguished by the mutual location of elements of the magnetic circuit); Fig. 2 shows one of the variants of the design of the accelerating system in which the commutation in each magnetic circuit is carried out by one spark gap located in the gap between the high-voltage busbar of the ring condenser and the grounded wall AB.

The ring commutator 1 and ring condenser 3, chargeable through resistor 2, together with the conductors of each transformer which connect them, form the torus-shaped primary circuit. A grounded

shield AECD serves as the secondary circuit in each unit of the accelerating system.

The current I, which appears as a result of the attenuating oscillating process with discharge of the condenser to the induct.ve load, creates a closed variable magnetic flux $\varphi = S\vec{B}d\vec{s}$, where $\vec{B}$ is the magnetic induction; and $d\vec{s}$ is the element of area of cross section of the primary circuit, which induces the vortex electrical field E, which is concentrated by the secondary circuit ABCD in the accelerating gap AD.

The magnetic flux is retained within the primary circuit - the ironfree magnetic circuit, by currents of conductivity and bias which create it. To avoid active losses, the thickness of the conducting walls of the primary circuit should be greater than the depth of the skin layer at the frequency of the discharge current I. Here the use of one of the walls of the primary circuit as a part of the secondary circuit is possible.

For the iron-free torus-shaped primary circuits, the minimal magnitude of scattering is provided with the use of the ring geometry of the capacitive storage devices and commutating devices.

The ring condenser can be gathered from low-inductive condensers, for example, of the ceramic type K 15-4, and the commutator can be a ring vacuum discharger or consisting of several parallel connected spark gaps located along the circumference.

However, with operation at high frequencies ($\geqslant$ 5 MHz), the existing vacuum ring dischargers do not provide the required precision of operation, and the replacement of the ring discharger by several spark gaps, which ensure the required synchronization, complicates the design of the accelerating system.

In the magnetic circuit in which the commutation is accomplished by one spark gap, a concen.rated stray inductance is present. It consists of the inductance of the spark, the coaxial of the discharger and part of the inductance of the two-conductor line formed by the grounded electrode of the discharger and the internal cylinder AE of the torus of rectangular section, but it can be made small in comparison with the total inductance of the primary circuit. This

can be achieved by means of decreasing the length of the two-conductor line, the coaxial and the spark gap. The most acceptable, from the viewpoint of accuracy of the commutation and requirements for inductance, is the controllable spark gap under pressure.

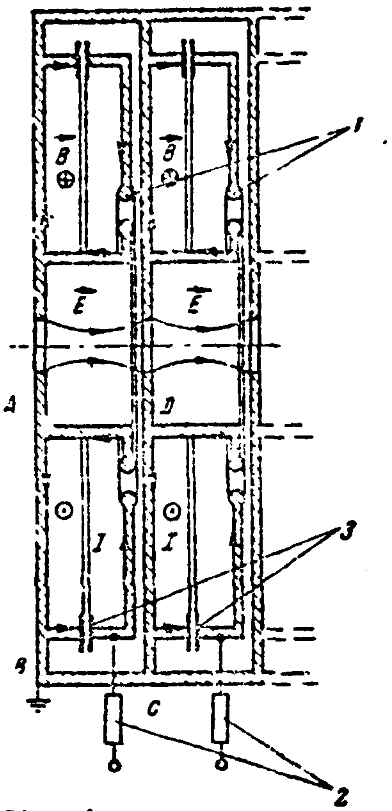

Fig. 1.

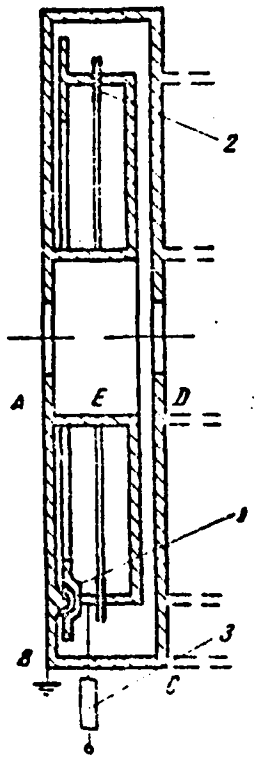

Fig. 2.

In each of the transformers forming the accelerating system, a high-voltage insulation, for example, from polyethelene, is necessary.

It is well-known that in an electrical field, the existing dielectrics age, i.e., their electroinsulation properties are lowered, and the electrical strength of the insulating elements is improved with short-term application of the voltage.

In the proposed design, for an increase in the service period of insulation of the capacitive storage devices and an increase in the voltage being transformed, we use a pulse discharge of the

capacitive storage devices, which are discharged simultaneously by means of commutators of each transformer upon reaching the assigned voltage.

It is advantageous to use similar accelerating systems in linear induction accelerators for obtaining single pulses or a series of pulses of current of the beam of charged particles with a large ($\gtrsim$ 1 kA) amplitude operating at a low repetition frequency ($\lesssim$ 0.1 Hz).

Claim of the invention

An induction linear accelerator which contains a series of series-connected accelerating transformers, storage devices, commutating devices, and an independent power supply source of transformers, which is distinguished in that for the purpose of increasing the operating frequency and transformable power, in each transformer the primary circuit is made in the form of a toroidal loop formed by a ring condenser, a commutating device, for example, of the ring type, and connecting conductors; and the secondary circuit, which is grounded and also of toroidal shape, surrounds the primary circuit, connected through a resistor with the pulsed power supply source.

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